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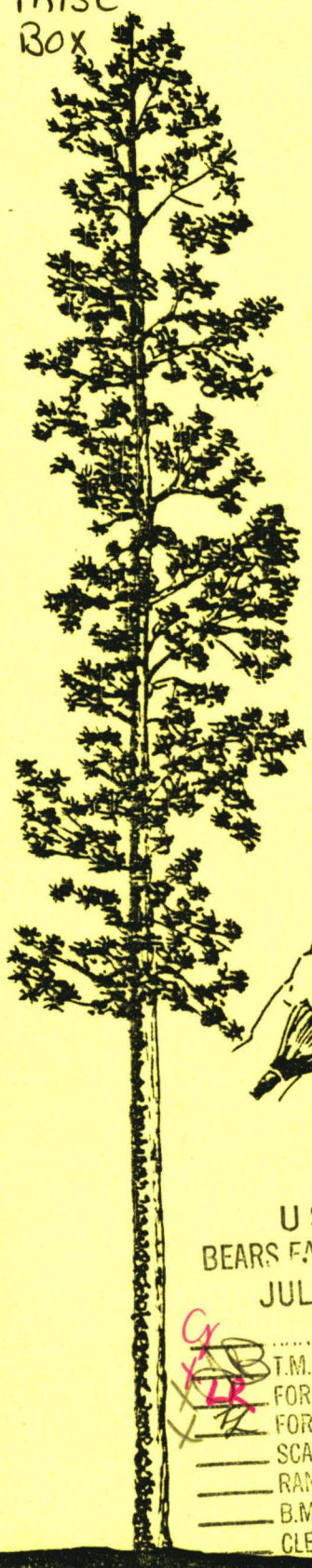
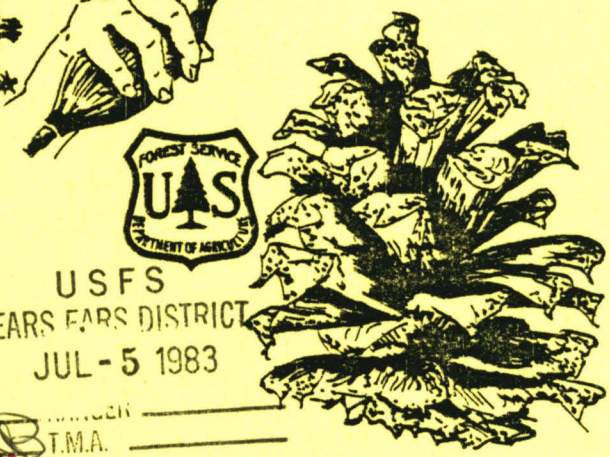
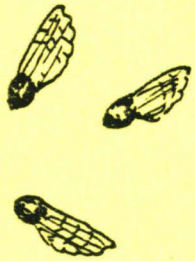
# Tree Improvement Program

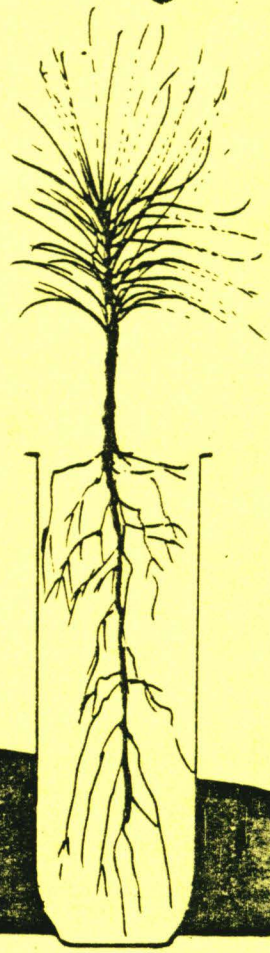
Forest Service U.S.D.A.

Rocky Mountain Region









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TREE IMPROVEMENT PROGRAM

ROCKY MOUNTAIN REGION
USDA Forest Service

Revised January 1983

Approved by: James R Beavers
Director, Timber, Forest Pest, and
Cooperative Forestry Management

Date 1-12-83

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Date 1/12/83

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# TREE IMPROVEMENT PROGRAM
# ROCKY MOUNTAIN REGION

## INTRODUCTION

The primary mission of the Timber Management System of the U.S. Forest Service is to increase growth, utilization and utility of wood and wood products to help meet the Nation's short and long-term needs (USDA Forest Service 1976a). Consumption of industrial wood products has been increasing steadily. Between 1942 and 1972 this increase amounted to 65 percent. Projections indicate that between 1970 and 2000 there will be increases in demand of 5 percent for saw logs, 58 percent for veneer logs, and 130 percent for round pulpwood (USDA Forest Service 1973). At the same time, as demand for forest products is increasing, there is a decreasing land base on which to grow these products.

In the 1974 Recommended Renewable Resources Program, the Chief recommended Goal C for timber; namely, to increase timber supplies and quality in an environmentally sound manner to the point where benefits are commensurate with costs (USDA Forest Service 1976a). Among several alternatives available for increasing timber supplies on a reduced land base is the utilization of sound genetic principles in all phases of forest regeneration. In general, limited genetic improvment may be expected in stands that are naturally regenerated (Zobel 1977). In contrast, genetic improvement achieved through artificial regeneration may be considerable. Increases of 10-15 percent in volume production have been achieved in other regions through use of genetically improved planting stock. Similar gains are possible in Region 2.

Congress, through the National Forest Management Act of 1976, has authorized a $200 million annual appropriation and directed an expedited schedule for reforestation and timber stand improvement in accordance with timber management plans. Resulting intensified timber management can be used to justify increases in timber harvests (USDA Forest Service 1976b).

If Region 2 is to contribute its full share toward meeting the National goal of increased timber supply on a reduced land base, the Region must utitize more intensive timber management practices, expand its artificial reforestation program, and tree improvement must be an integral part of its timber management program. A tree improvement program for the National Forests in Region 2 must include: 1) incorporation of sound genetic principles in the management of naturally regenerated stands, and 2) use of improved seed, seedlings, and cuttings for artificial regeneration.

## OBJECTIVES

The objectives of the Region 2 Tree Improvement Program are:

A. To provide a continuing supply of improved seed to meet annual artificial regeneration needs for all species. Use of improved seed will result in:

    1. Increased survival resulting from use of well-adapted planting stock produced from local seed.

2. Increased yields of usable fiber (sawtimber, roundwood poles, posts, etc.).

3. Improved tree quality.

4. Reduced susceptibility to diseases, insects, and other pests.

B. To incorporate genetic principles in the culture and management of trees for forest products and other uses.

## CURRENT SITUATION

### Productive Forest Land

In 1981 there were about 10.3 million acres of tentatively available and suitable land on the National Forests in Region 2 (Table 1). Of this total, about 69 percent (7,094 M acres) was in the 20-49 CF/Ac/Yr yield class; the remaining 31 percent (3,213 M acres) was in the 50 or more CF/Ac/Yr yield class.

Included in the productive forest land base is 3,071 M acres (30%) with spruce/fir type, 2,094 M acres (20%) in ponderosa pine, 1,127 (11%) in Douglas fir/white fir, 2,119 M acres (21%) in lodgepole pine, less than 100 M acres (less than 1%) in other softwoods, and 1,896 M acres (18%) in aspen. In excess of 90 percent of the ponderosa pine (92%) and lodgepole pine (91%) are in the 20-49 CF/Ac/Yr yield class. For the other forest types, about 69 percent of the aspen, 51 percent of the Douglas fir/white fir, and 45 percent of the spruce/fir are in this same yield class.

Acres of productive, non-reserved, non-deferred forest land by National Forest type and yield class are summarized in Table 2.

Land and Resource Management Plans proposed for National Forests in Regions 2 indicate that the land base for timber production will be reduced significantly. Tentative allocations of lands suitable for timber production total approximately 5,200 M acres. This proposed total amounts to about 50 percent of the 10,300 M acres tentatively available and suitable in 1981. A reduction of this magnitude further emphasizes the need for a tree improvement program in Region 2 if the Region is to realize its goal of an increased timber supply from a significantly reduced land base.

### Artificial Regeneration

During the ten-year period 1972-1981, approximately 8,800 acres per year were artificially regenerated in Region 2 (Table 3). This amounted to about 60 percent of the acres regenerated in the Region during this time period. Prior to 1978, about 45 percent of the regeneration in the Region was by planting and direct seeding. For the period 1978-1981, in excess of 75 percent of the regeneration was by artificial means; the majority of these acres were in the backlog category. Variation among years during this period ranged from 5,512 acres in 1975 to 13,941 acres in 1980.

TABLE 1 - FOREST LAND BY TYPE AND YIELD CLASS 1/
(M Acres)

| Forest Type | Yield Class | | Total |
|---|---|---|---|
| | 20-49 CF/Ac | 50 or more CF/Ac | |
| Spruce/Fir | 1369 | 1702 | 3071 |
| % of Total | 44.6 | 55.4 | 29.8 |
| Ponderosa Pine | 1927 | 167 | 2094 |
| % of Total | 92.0 | 8.0 | 20.3 |
| Douglas-Fir | 573 | 554 | 1127 |
| % of Total | 50.8 | 49.2 | 10.9 |
| Lodgepole Pine | 1922 | 197 | 2119 |
| % of Total | 90.7 | 9.3 | 20.6 |
| Aspen | 1303 | 593 | 1896 |
| % of Total | 68.7 | 31.3 | 18.4 |
| TOTAL | 7094 | 3213 | 10,307 |
| | 68.8 | 31.2 | 100.0 |

1/ Productive, non-reserved, non-deferred forest land

TABLE 2 - FOREST LAND BY NATIONAL FOREST, TYPE AND YIELD CLASS 1/

| Forest | Type | Yield Class: 20-49 CF/Ac SF 2/ | PP | DF | LP | AS | 50 or more CF/Ac SF | PP | DF | LP | AS | Forest Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bighorn | M Acres | 105 | 7 | 35 | 305 | 5 | 44 | | 21 | 9 | | 531 |
| | % of total | 19.8 | 1.3 | 6.6 | 57.4 | 0.9 | 8.3 | | 4.0 | 1.7 | | |
| Black Hills | M Acres | 2 | 957 | | | 21 | 19 | 98 | | | 7 | 1104 |
| | % of total | 0.2 | 86.7 | | | 1.9 | 1.7 | 8.9 | | | 0.6 | |
| GM, Unc, & Gunn. | M Acres | 206 | 215 | 21 | 194 | 374 | 249 | 9 | 24 | 5 | 154 | 1451 |
| | % of total | 14.2 | 14.8 | 1.4 | 13.4 | 25.8 | 17.2 | 0.6 | 1.7 | 0.3 | 10.6 | |
| Medicine Bow | M Acres | 115 | 76 | 11 | 311 | 26 | 150 | | 10 | 64 | 29 | 792 |
| | % of total | 14.5 | 9.6 | 1.4 | 39.3 | 3.3 | 18.9 | | 1.3 | 8.1 | 3.7 | |
| Rio Grande | M Acres | 270 | 23 | 65 | 19 | 148 | 200 | 7 | 49 | | 103 | 884 |
| | % of total | 30.5 | 2.6 | 7.4 | 2.1 | 16.7 | 22.6 | 0.8 | 5.5 | | 11.7 | |
| Arapaho and Roosevelt | M Acres | 190 | 100 | 49 | 471 | 54 | 98 | | 11 | 19 | 16 | 1008 |
| | % of total | 18.8 | 9.9 | 4.9 | 46.7 | 5.4 | 9.7 | | 1.1 | 1.9 | 1.6 | |
| Routt | M Acres | 61 | | | 141 | 157 | 251 | | | 50 | 66 | 726 |
| | % of total | 8.4 | | | 19.4 | 21.6 | 34.6 | | | 6.9 | 9.1 | |
| Pike and San Isabel | M Acres | 201 | 244 | 296 | 173 | 98 | 87 | 17 | 138 | 8 | 64 | 1326 |
| | % of total | 15.2 | 18.4 | 22.3 | 13.0 | 7.4 | 6.6 | 1.3 | 10.4 | 0.6 | 4.8 | |
| San Juan | M Acres | 85 | 305 | 82 | | 200 | 278 | 36 | 144 | | 52 | 1182 |
| | % of total | 7.2 | 25.8 | 6.9 | | 16.9 | 23.5 | 3.0 | 12.2 | | 4.4 | |
| Shoshone | M Acres | 9 | | | 212 3/ | 6 | 78 | | 124 | 15 3/ | 7 | 451 |
| | % of total | 2.0 | | | 47.0 | 1.3 | 17.3 | | 27.5 | 3.3 | 1.6 | |
| White River | M Acres | 125 | | 14 | 96 | 214 | 248 | | 33 | 27 | 95 | 852 |
| | % of total | 14.7 | | 1.6 | 11.3 | 25.1 | 29.1 | | 3.9 | 3.2 | 11.2 | |
| TOTAL | M Acres | 1369 | 1927 | 573 | 1922 | 1303 | 1702 | 167 | 554 | 197 | 593 | 10307 |
| | % of total | 13.3 | 18.7 | 5.6 | 18.6 | 12.6 | 16.5 | 1.6 | 5.4 | 1.9 | 5.8 | |

1/ Productive, non-reserved, non-deferred forest land. Pike and San Isabel NF data is productive, non-reserved from 1979-80 Forest-wide inventory; other Forest data from 1979 RPA assessment.

2/ SF = Spruce-fir; PP = ponderosa pine; DF = Douglas-fir (includes white fir); LP = lodgepole pine, AS = aspen.

3/ Includes some whitebark and limber pine.

TABLE 3 - PLANTING AND DIRECT SEEDING
(Acres)

| Year | Total | Seeding | Planting | Tree/A |
|---|---|---|---|---|
| 1972 | 7,802 | 865 | 6,940 | 479 |
| 1973 | 6,615 | 699 | 5,916 | 412 |
| 1974 | 7,701 | 671 | 7,030 | 394 |
| 1975 | 5,512 | 1,223 | 4,289 | 375 |
| 1976 | 9,521 | 5,305 | 4,216 | 377 |
| 1977 | 5,929 | 1,627 | 4,302 | 344 |
| 1978 | 11,148 | 1,713 | 9,435 | 348 |
| 1979 | 12,905 | 2,435 | 10,470 | 323 |
| 1980 | 13,941 | 349 | 13,592 | 410 |
| 1981 | 6,932 | 719 | 6,213 | 400 |

Direct seeding during these years averaged about 1,561 acres or about 18 percent of the total acres artificially regenerated annually. Variation among years ranged from 349 acres (3% of artificial regeneration) in 1980 to 5,305 acres (56% of artificial regeneration) in 1976. About 70 percent of all the direct seeding in the Region during this ten-year period was done by the Bighorn NF (660 A/Yr-42% of total direct seeding) and the Routt NF (430 A/yr-28% of total direct seeding). Most direct seeding in the Region has been in lodgepole pine with minor amounts seeded to ponderosa pine and Engelmann spruce. Success with direct seeding has been extremely variable and in only a few instances has this method of artificial regeneration been considered as successful.

Until the success rate with direct seeding can be raised substantially, this method of artificial regeneration will probably be limited, especially with increasing costs of seed, to a few hundred acres annually.

Planting during the same ten-year period has averaged about 7,200 A/yr. Variation among years during this time ranged from 4,216 acres in 1976 to 13,592 acres 1980. Planting targets set for 1982 exceed 11,000 acres; however, due to considerable falldown in contract, container grown, stock this target will not be met.

Anticipated planting for the period 1983 to 1985 is estimated to be about 6,500 acres annually (Figure 1). This will amount to about 50 percent of the targeted reforestation acres.

After 1985, the best estimates of artificial reforestation needs will probably decrease to about 20-25 percent of the annual reforestation targets. This will amount to about 3,000-3,500 acres annually. While this estimate may appear to be low, it is probably a realistic estimate since the trend in the Region is toward natural regeneration, especially in Engelmann spruce and lodgepole pine. At an average planting rate of 500 trees/acre, this will require about 1.5-1.75 MM trees per year.

Between 1974 and 1981 approximately 23.7 million trees (bareroot and container stock) were planted on the National Forests in Region 2 (Table 4). This amounts to about 2.96 million trees annually. Included in this total was 11,006 M (46% of the total) Engelmann spruce, 6,782 M (29%) ponderosa pine, 5,429 M (23%) lodgepole pine, 310 M (1%) Douglas-fir, and 144 M (less than 0.5%) white fir.

In 1982, slightly less than 6 million trees were to have been planted; however, due to the considerable falldown in contract container stock, probably less than 5 million trees will actually be planted. In 1983, about 3.4 million trees are scheduled to be planted in the Region.

The projected tree needs for 1982 and 1983 (Table 4) show that about 40 percent of the trees scheduled for planting will be Engelmann spruce, 40 percent will be ponderosa pine, slightly less than 20 percent will be lodgepole, and between 1 and 2 percent will be Douglas-fir. Projections of planting stock needs after 1983, and especially after the backlog is completed in 1985, suggest that species priorities for planting in the Region will probably shift considerably. They will probably rank in the following decreasing order: ponderosa pine, lodgepole pine, Engelmann spruce, and Douglas-fir.

FIGURE 1

PLANTING
1975-1985

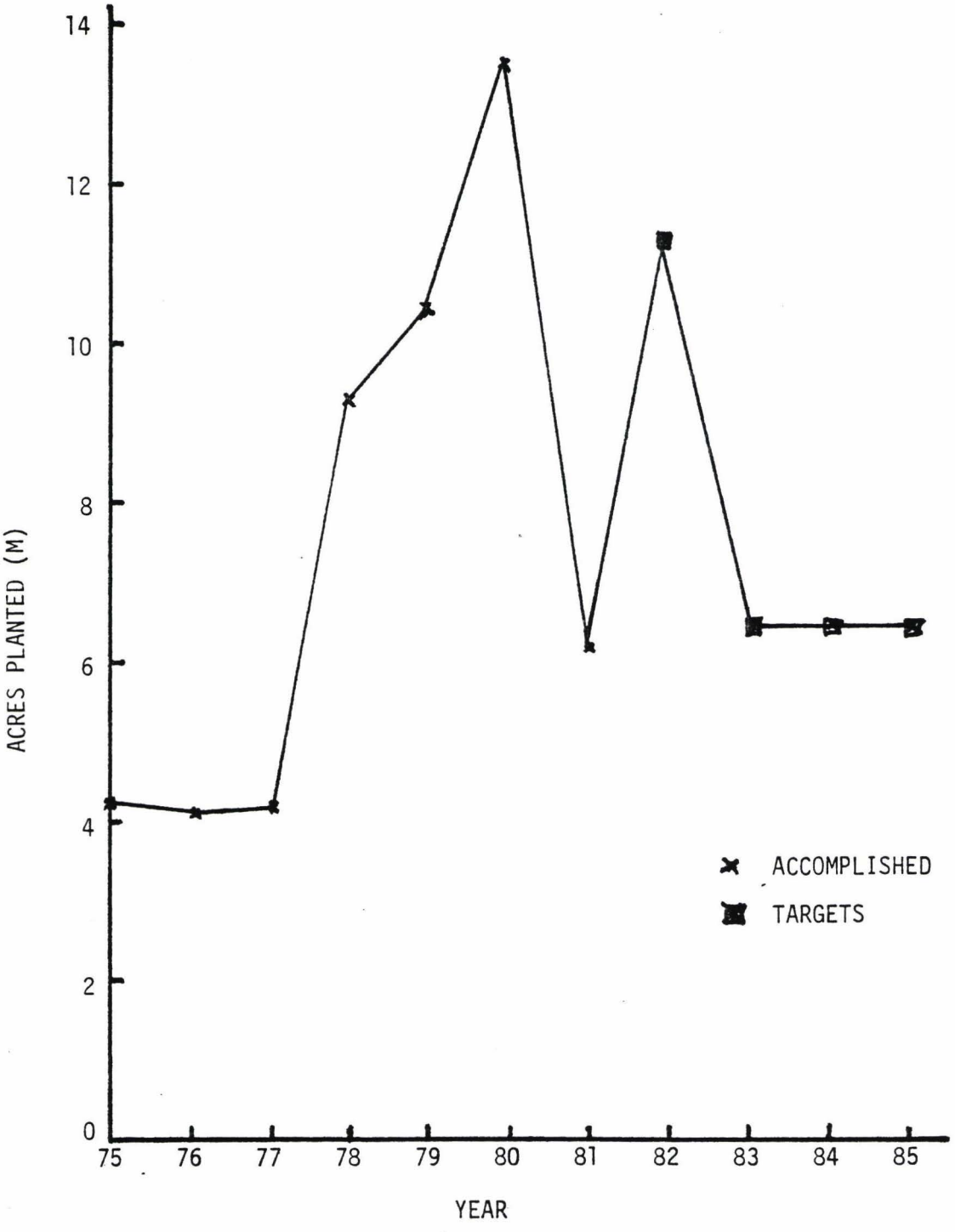


TABLE 4 - TREE PLANTING BY SPECIES
(M Trees)

| | 1974 1/ | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|
| Engleman Spruce | 1136 | 167 | 931 | 648 | 2291 | 2443 | 2110 | 1280 | 2290 | 1397 |
| % of Total | 41.9 | 10.4 | 47.9 | 56.3 | 54.4 | 62.2 | 37.7 | 50.6 | 38.3 | 40.7 |
| Ponderosa Pine | 671 | 984 | 364 | 94 | 935 | 779 | 2187 | 768 | 2203 | 1434 |
| % of Total | 24.8 | 61.5 | 18.7 | 8.2 | 22.2 | 19.8 | 39.0 | 30.4 | 36.9 | 41.8 |
| Lodgepole Pine | 839 | 376 | 602 | 399 | 985 | 665 | 1136 | 427 | 1423 | 549 |
| % of Total | 31.0 | 23.5 | 31.0 | 34.7 | 23.4 | 16.9 | 20.3 | 16.9 | 23.8 | 16.0 |
| Douglas-Fir | 62 | 74 | 48 | 10 | - | - | 63 | 53 | 61 | 49 |
| % of Total | 2.3 | 4.6 | 2.5 | 0.9 | | | 1.1 | 2.1 | 1.0 | 1.4 |
| White Fir | - | - | - | - | - | 38 | 106 | - | - | - |
| % of Total | | | | | | 1.0 | 1.9 | | | |
| TOTAL | 2708 | 1601 | 1945 | 1151 | 4211 | 3925 | 5602 | 2528 | 5977 | 3429 |

1/ Actual 1973-1981
Planned 1982-1983

## SPECIES PRIORITIES

Species priorities in the Region 2 tree improvement program in descending order are:

1. Ponderosa pine
2. Lodgepole pine
3. Engelmann spruce
4. Douglas-fir

These priorities are based upon projected planting needs, potential genetic improvement, and costs involved in anticipated tree improvement activities designed to meet the needs in Region 2.

On an individual National Forest, species priorities for tree improvement activities will be different from the Regional priorities; consequently, each Forest will develop their own species priorities depending upon their specific species and needs for improved plant materials.

## PROGRAM INTENSITY LEVELS

There are five tree improvement program intensity levels specified in the Forest Service Manual (FSM 2475.3) which are ranked according to increasing complexity based upon input and potential genetic gain that can be attained. These levels include 1) seed collection zones, 2) seed collection stands, 3) seed production areas, 4) seed orchards, and 5) selective breeding.

### Level 1 - Seed Collection Zones

All states in Region 2 have been zoned for tree and shrub seed collection (Cunningham 1975, Seed Collection Zone Maps, R2-2470-15a, b, and c). These zones were developed by first subdividing each state into regions based on major land resource areas developed by the Soil Conservation Service (Austin 1972) utilizing soil, climate, and land use data. The major land resource areas were subdivided into seed collection zones by superimposing climatic data, including mean January temperature and normal annual precipitation (U.S. Dept. of Commerce 1968), on the major land resource use areas. Seed zone boundaries were adjusted in some instances to conform to recognizable local land features such as lakes, river, and highways. Development of these seed collection zones was a cooperative effort involving Timber Management, State and Private Forestry, and Research and State agencies. Seed collection zone boundaries will be evaluated and adjusted, if necessary, when research and evaluation plantation data becomes available.

A long-term record keeping system has been developed and is maintained by the Regional Geneticist to ensure maintenance of identity of reproductive material through all stages of collection, processing, storage, nursery production, and distribution including final use in reforestation and tree improvement projects.

Tree Seed is collected on National Forests in Region 2 from designated seed zones and within 500 feet elevation of future planting sites within the

designated seed zone. Identity of the seed is carefully maintained by species, seed collection zone, elevation, seed source, Forest, District, and year of collection.

Seed or planting stock from these known seed sources is utilized within the source seed collection zone and within 500 feet elevation of seed origin. Seed is collected from a minimum of 20 individual trees or 7 squirrel caches within designated stands to ensure maintenance of a broad genetic base. Plant reproductive materials (seed, seedlings, or cuttings) are not exchanged between seed zones without the approval of the Regional Forester or his representative.

Shrub Seed - Little is known about genetic variation and improvement methods and techniques for shrub species that may be utilized in Region 2. Consequently, until more specific information is available shrub seed should be collected and utilized within local seed collection zones.

Seed Handbook - The Region 2 Seed Handbook (FSH 2409.26f) provides guidelines and information on objectives, responsibilities, needs, seed source, and identity control, cone collection and handling, and seed handling.

Level 2 - Seed Collection Stands

Seed collection stands are groups of individual trees or stands within seed collection zones that exhibit above average performance and are managed for seed production. They should be located on sites and at elevations representative of future planting areas. Seed collection stands should be designated for repeated seed collection, marked, and reserved from timber harvest. However, to ensure that seed is collected only from good phenotypes, inferior phenotypes should be removed (rogued) within groups of individuals and within stands. After roguing, these stands will be considered as seed production areas (SPA).

Seed collection stands and seed production areas will be the primary sources of seed for Region 2 until seed is available from seed orchards and/or tested selected individuals. Seed from these later sources probably will not be available before 2010.

Guidelines for the selection and maintenance of seed collection stands are included in the Region 2 Tree Improvement Handbook (FSH 2409.26g). The Regional Geneticist is responsible for certifying seed collection stands for inclusion in the Regional seed collection program.

Level 3 - Seed Production Areas

Seed Production areas are usually established in tested and proven natural stands. Undesirable individuals are removed and the best individuals treated to promote early and abundant seed production. These stands are usually protected against serious damaging pests.

As selection and testing programs are implemented in the Region, seed from individuals in seed production areas will be tested to determine those areas that should be retained for future seed production.

Promising families produced from individuals selected in seed production areas will be retained and included in the National Forest tree improvement programs. Forest personnel, in consultation with the Regional Geneticist, are responsible for location, establishment, and maintenance of seed production areas.

Level 4 - Seed Orchards

Seed orchards are plantations of clones (a clone is a group of genetically identical individuals produced asexually by grafting or rooting of cuttings from a single individual) and/or seedlings from selected trees managed for early and abundant seed production.

The Regional Geneticist, in cooperation with other Federal, State, and private organizations, will establish the boundaries of breeding zones: geographic areas based on anticipated adaptability of an improved population of trees for each of the species included in the tree improvement program. A breeding zone may be larger than a seed collection zone.

Environmental variables including climate, soils, provenance research, and evaluation plantation results can be utilized in determining breeding zones. The Regional Geneticist, in cooperation with other agencies, will determine the best locations for the Region's seed orchards.

Level 5 - Selective Breeding

Selective breeding, which involves production of seed of known parentage to provide improved materials for advanced-generation seed orchards, will become a part of the Regions's tree improvement program following establishment of first generation orchards and evaluation of individuals in these orchards.

Because greatest overall gain will be achieved on the most productive sites, seed orchards will be established only for those areas with sufficient acreage of highly productive forest land to economically justify their establishment and management. Planting stock produced from seed orchard seed will be used only on the most productive sites (productivity 50 plus).

## INDIVIDUAL TREE SELECTION

Natural Regeneration

In stands to be naturally regenerated all silviculturally undesirable trees should be removed during precommercial thinning. Desirable trees of good form and growth rate should be marked as parent seed trees and be retained until final harvest cuts. The Regional Geneticist, in cooperation with Forest personnel, will develop and incorporate selection criteria for leave trees into Region 2 marking guidelines.

Parent Tree Selection and Progeny Testing

Selection of individual parent trees in natural stands and testing of their progeny will be the first major step in the development of an intensive tree improvement program in the Region.

Because high intensity selection programs have rarely paid off, a relatively low intensity selection program will be used to identify and progeny test a large number (200-300) of trees per breeding zone.

Parent tree selection began in the Region in 1979. Initial parent tree selections will be made on the following Forests:

| Species | Forests |
|---|---|
| Ponderosa pine | Black Hills, Grand Mesa-Uncompaghre/ Gunnison, San Juan |
| Lodgepole pine | Medicine Bow, Arapaho/Roosevelt Routt |
| Engelmann spruce | San Juan |

Guidelines for locating, selecting, and identifying superior trees and testing of superior tree selections are included in the Region 2 Tree Improvement Handbook (FSH 2409.26g). Forest personnel are responsible for locating and nominating candidate superior trees, and the Regional Geneticist will certify candidate superior trees for inclusion in tree improvement programs.

## TRAITS TO BE IMPROVED

Survival - Improved survival will be achieved in Region 2 through use of well-adapted, local sources of plant reproductive materials; good quality planting stock; and the best cultural methods and techniques available for establishment and maintenance of plantings. Non-local sources of plant reproductive materials will be used only when administrative studies or research has demonstrated that such materials are better adapted to environments than local origin materials.

Growth and Form - Individuals retained as seed parents for natural regeneration and those selected for use in tree improvement programs should exhibit better-than-average annual height and diameter growth and good quality stem, branch, and crown characteristics.

Pest Resistance - Activities specifically designed to develop pest resistant individuals will not be implemented in the Region. However, all individuals used as seed parents for natural regeneration and in tree improvement programs will be free of serious pest incidence.

## GENE RESOURCE MANAGEMENT

The basis of tree improvement is genetic diversity, and the increasing demand for forest and forest related products may lead to indiscriminant mixing, impoverishment, or elimination of natural gene resources. Such changes in indigenous forest tree species are irreversible, and concerted efforts must be made to conserve the natural gene resources of these species.

## Natural Regeneration

Regeneration of most tree and shrub species on National Forest lands in Region 2 will be predominantly by natural regeneration. In instances where a unique gene resource is in danger of becoming impoverished or eliminated, concerted and directed efforts will be made to retain that resource both through natural regeneration (*in situ*) and long-term storage of a portion of the resource in the form of seed (*ex situ*). Gene resource conservation units may add to, but will be distinct from gene banks of tree improvement programs.

## Artificial Regeneration

On lands to be artificially regenerated several activities will be utilized to guard against impoverishment of gene resources including:

1. Use of local, well-adapted sources of plant reproductive materials.

2. Maintenance of a broad genetic base. Each seed collection made under tree improvement intensity level 1-3 programs will include seed from a minimum of 20 individual trees or 7 squirrel caches well distributed throughout the seed collection area.

3. Generally, seedlots produced from level 4 and 5 tree improvement activities and used in reforestation programs will contain mixtures of seed from a minimum of 75 individuals.

4. Clonal mixtures consisting of a minimum of 10 genotypes will be used in plantings of three or more acres when vegetatively propogated materials are used.

5. Plant reproductive materials resulting from level 4 and 5 programs will be used on the same lands from which original parent materials were selected.

## Gene Resource Inventory

The Regional Office will maintain an inventory of commercial tree species and shrubs and non-commercial tree species, and their locations, that may be in danger of gene pool impoverishment or elimination.

The inventory will include a listing of "set-aside" areas such as research natural areas, wilderness areas, National Parks and Monuments, and modified management areas such as scenic areas, gene conservation areas, and *ex situ* areas where representative samples of limited gene resources exist or are maintained.

The Region will encourage and cooperate with other Federal, State, private, and international organizations in gene pool conservation efforts, especially on extensive Forest acreages where gene pool conservation may not otherwise occur.

## PERSONNEL AND RESPONSIBILITIES

### Regional Geneticist

The Regional Geneticist will develop and implement a Regional Tree Improvement Program for the National Forests in the Rocky Mountain Region. He will also provide training, technical expertise, and guidance in tree improvement to National Forest personnel in the Region.

The Regional Geneticist will be responsible for coordinating the Region's tree improvement program with the tree improvement programs of other Federal, State, and private organizations within the states in the Region.

The Regional Geneticist will develop procedures for maintaining long-term (minimum of one rotation) recordkeeping systems to ensure maintenance of identity of tree seed and other Forest reproductive material through all stages of collection, processing, storage, nursery production, and distribution including final use and tree improvement projects. (FSM 2475.03,8)

The Regional Geneticist will also be responsible for developing and maintaining a Regional Tree Improvement Handbook. The Tree Improvement Handbook will provide specific direction and technical guidelines needed to meet the Regional tree improvement objectives.

### Forest Supervisors

Forest Supervisors will implement the Regional Tree Improvement Program and assist in development of individual Forest tree improvement plans by designating an individual responsible for planning and coordinating tree improvement activities on the Forests; and by cooperating with adjacent Forests and other Federal and State agencies and private individuals and organizations in cooperative tree improvement projects.

### District Rangers

District Rangers are responsible for maintaining a 10-year seed supply for each species involved in reforestation within each seed collection zone of their district (FSM 2474.2).

### Nurseryman at the Mt. Sopris and Bessey Nurseries

1. Store genetically improved seed.

2. Produce seedling and clonal stock for progeny testing, seed orchards, and breeding material.

3. Produce genetically improved planting stock for the National Forests.

4. Produce genetically improved planting stock for other Federal and State agencies and private individuals and organizations under cooperative agreements.

5. Carry out assigned administrative studies in tree improvement.

## NATIONAL FOREST TREE IMPROVEMENT PLANS

Each Forest will develop a Tree Improvement Plan based on the general direction provided in the Regional Tree Improvement Program by October 1, 1983. Forest plans should include detailed schedules of activities and target dates. Requests for funding for tree improvement activities should be included in the Forest program budget process.

## COOPERATION

In order to maximize the benefits of tree improvement, the Regional Tree Improvement program will be coordinated with State and Private Forestry tree improvement programs, research, other Regions, other Federal agencies, universities and private organizations in developing and implementing its tree improvement program. The Region will actively participate in cooperative tree improvement organizations such as the Rocky Mountian Forest Genetics Committee, Western Forest Genetics Association, and the Great Plains Agricultural Council, GP-13 Technical Committee ("Improved Trees for the Great Plains").

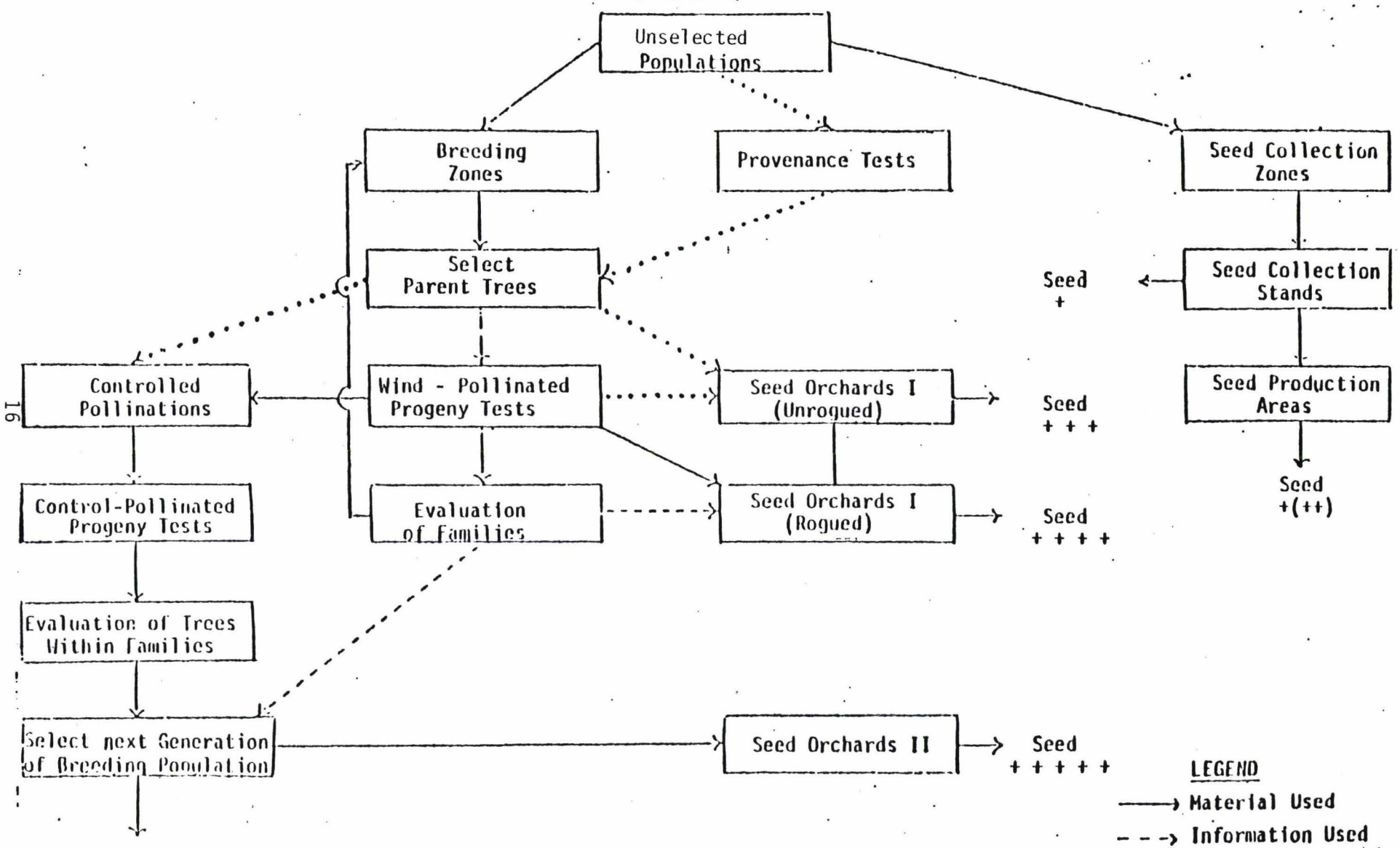
## REGIONAL TREE IMPROVEMENT PLAN REVIEW

This plan should be reviewed, updated, and revised, as necessary, every five years. However, flexibility should be maintained in the Region 2 and individual Forest tree improvement programs at all times.

## FUNDING

Requests for funding for tree improvement activities will be handled through the normal budgetary process.

FLOW CHART - REGION 2 TREE IMPROVEMENT PROGRAM
(FIGURE 2)




NOTE: Relative genetic improvement varies from slight (+) to most (+ + + + +)

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